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DISCUSSION PAPER

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INTELLECTUAL CAPITAL VALUATION: CASE OF RUSSIAN COMPANIES

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The paper dwells on Intangible Assets (IA), covering a range of their definition, composition and evaluation problems. The main research objective is to define the impact of fundamental value of both tangible and intangible assets on the market value of assets of Russian companies. As a general approach used herein for IA evaluation, the method of *Calculated Intangible Value (CIV)* offered by T. Stewart was chosen. According to CIV the evaluation of intangible assets is based on *Residual Operating Income (REOI)* model as a variant fundamental value of equity model. The paper gives the definition of Intangible Assets, reveals their correlation with the concepts of «*Intellectual Capital*» and «*Intangibles*», covers the problem of Intangible Assets composition and structure. Developed econometric models are tested on the data of Russian stock market from 2001 to 2005 year. In the focus of the research there is both the analysis of the sampled companies (43 companies) as a whole as well as divided into five aggregated fields: mechanical engineering, extractive industry, power engineering, communication services, and metallurgy. In conclusion, the main directions for further research in this field are outlined.

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INTRODUCTION

The knowledge in nowadays economy becomes a locomotive that defines the development of the contemporary companies. The successful companies are, undoubtedly, those constantly introducing the innovations based on new technologies as well as on knowledge, experience and attainments of their employees. It is arguable that the value of companies is now mostly generated by Intangible Assets, and not by "traditional" assets having the tangible form.

The surveys reveal that 2/3 American companies have recently turned to pro-active thinking and place a higher emphasis on collection and analysis of non-financial data. The same surveys confirm the fact, that one third of all the effected investment solutions is based on the existing Intangible Assets, and that the decisions made on the basis of Intangible Assets allow to make a more accurate prediction of income and profitability of a company in the future, and, hence, the company's value for the shareholders. The inclusion of the effects connected with the Intangible Assets of a company into the measuring system of the activity results admits making them more efficient, and, therefore, opens the possibility of making executive compensation system more efficient as well.

In this article, the main aim of the research is to define the impact of fundamental value of both tangible and intangible assets on the market value of assets of Russian companies. The conclusions shall be made both on the whole sample of the companies under consideration, as well as from the point of their belonging to a certain field. However, before presenting the results of the research carried out by the authors, let us dwell on the following by now sharply debatable problems:

- the problem of defining Intangible Assets and connection of this concept with such categories as «Intellectual Capital», «Intangibles», «Knowledge Assets» etc.;
- the problem of composition and structure of the Intangible Assets;
- the question of Intangible Assets evaluation models.

Upon consideration of the above mentioned problems, the authors formulate their personal position. The analysis of Intangible Assets evaluation models is limited to only one model on which the empirical study is carried out.

THE APPROACHES TO INTANGIBLE ASSETS AND INTELLECTUAL CAPITAL DEFINITION

There exist various approaches to defining the *Intangibles*, *Intangible Assets* and *Intellectual Capital*. Some authors consider these terms to be synonyms, while the others still separate them from each other. Apart from that, a number of authors do not offer any definition, but only separate the

basic components, being a part of the concepts referred above. Without claiming the completeness, lets us examine the basic approaches to defining Intangible Assets and Intellectual Capital. At that, we shall firstly give the approaches to the definitions of the concepts, and afterwards consider the composition and structure of Intangible Assets (Intellectual Capital).

According to the opinion of B. Lev, to which the authors of this paper subscribe, the terms Intangible Assets, Knowledge Assets and Intellectual Capital are interchangeable owing to the fact that all three terms are "widely used: Intangible Assets in accounting literature, Knowledge Assets – by economists, Intellectual Capital — in management and law literature; and on the whole they come to the same: to the future benefits that are not embodied materially" [Lev, 2004].

Hence, Intangible Assets, or Intellectual Capital, are defined by B.Lev as "non-physical sources of value (claims to future benefits) generated by innovation (discovery), unique organizational designs, or human resource practices". Intangible Assets, as defined in [Lönnqvist, Mettänen, 2002], are non-material sources of creating a company's value, based on the employees capabilities, organizations' resources, the way of operating and relations with the shareholders. In [Lönnqvist, Mettänen, 2002), as in [Lev, 2004], the terms *Intellectual Capital* and *Intangible Assets* are suggested for interchangeable usage.

The generic definitions presented above may be somewhat concretized. Thus, [Rechtman, 2001] mentions the following definition given by the Financial Accounting Standards Board (FASB), according to which one can refer to Intangible Assets the assets having no material form that appear as a result of (1) *past events* that has a (2) *measurable effect* and that presents a (3) *future benefit*. The similar definition, but referring to *Intangibles* is given in [Bouteiller, 2002], where they are defined as assets arising as a result of past events and possess three main attributes: they are non physical in nature, they are capable of producing future economic net benefits, and they are protected legally or through a de facto right.

As shown earlier, along with *Intangible Assets* concept the term "*Intellectual Capital*" is used. Various definitions of Intellectual Capital are mentioned in [Klein, Prusack, 1994; Edvinsson, Mallone, 1997; Stewart, 1997; Sullivan, 2000]. In [Bouteiller, 2002], the definitions of Intellectual Capital existing in literature are generalized, and the following variant is suggested: "Intellectual Capital — is a developmental knowledge that is human, structural, and customer-based, and needs to be aligned with the corporate strategy and formalized / packaged in some way." We would like to separately stress, that in [Bouteiller, 2002], as well as in [Lev, 2003], the concepts of Intangible Assets and Intellectual Capital are synonyms. A.Brooking in [Brooking, 1996, p.12] adheres to the same position and

considers Intellectual Capital as the term given to the combined Intangible Assets which enable the company to function.

At the same time, there are quite a number of papers that make a difference between the concepts of Intellectual Capital and Intangible Assets. Thus, in particular, in [Ståhle, Grönroos, 2000, p.192-199], Intellectual Capital concept is divided into potential and realized one, i.e. leading to the increase of Economic Value Added. At the same time, it is accentuated, that Intangible Assets are only a constituent part of the potential Intellectual Capital. In [Starovic, Marr, 2003], a widespread approach is described, under which Intellectual Capital (or Intangibles) is a broader concept than Intangible Assets. In this sense, Intangible Assets are only a part of Intellectual Capital acknowledged as the assets in a company's bookkeeping and accounting records.

The authors assume that narrowing of the Intangible Assets concept only to the assets acknowledged in accounting is unjustified. Such opinion is a result of confusing two different problems. Firstly, what an asset is in general, and secondly, which assets can be acknowledged in accounting and which can not. In view of the fact that under the asset is basically understood any possible future economic benefit, obtained and controlled by a company, as a result of past transactions and events [Volkov, 2006a], then all the elements (tangible or intangible) coming within the above definition appear to be a company's assets.

It is quite another matter, if these elements match the criteria of recognition in bookkeeping and accounting or not. Thus, according to [IFAC 38], "intangible asset is an identifiable non-monetary asset, having no physical form and serving for production usage or for providing the goods or services, for rental to others or for administrative purposes." The Russian accounting standards [PBU 14/2000] supplement the enumerated criteria with a range of conditions for "recognition assets by accounting and bookkeeping as intangible". Consequently, if summarizing the criteria of recognition of Intangible Assets, it appears that any non-financial, non-physical assets that can be divided from other property of the company and having the utility period of (as a rule) more that 12 months may be referred to Intangible Assets.

Thus, the authors' position may be summarized as follows. Any asset, belonging to a company or controlled by it, having no physical or financial (in case of financial investment) form, but capable of producing future economic benefits is an Intangible Asset. The aggregate of Intangible Assets of a company may also be named Intellectual Capital, or Intangibles. At the same time, two subgroups should be distinguished within Intangible Assets: *recognized Intangible Assets* and *non-recognized Intangible Assets* in bookkeeping and accounting (see Figure 1).

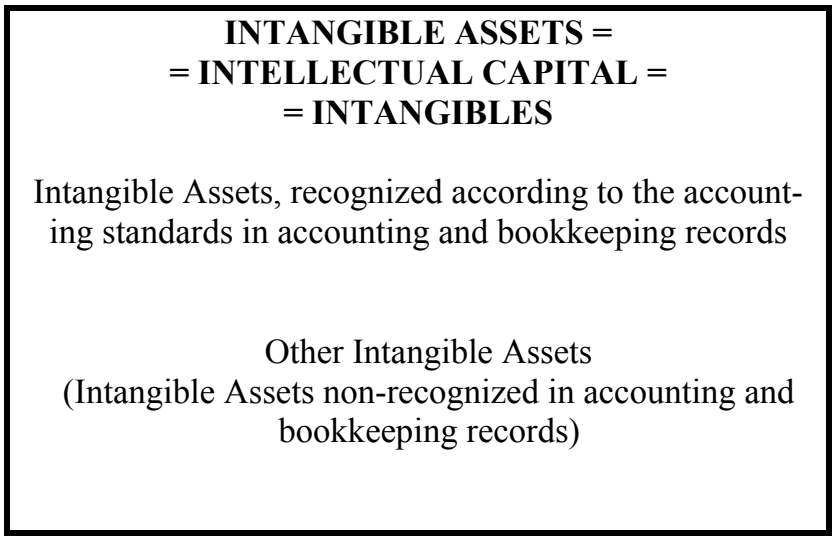

Figure 1. The Intangible Assets Concept

COMPOSITION AND STRUCTURE OF INTANGIBLE ASSETS (INTELLECTUAL CAPITAL)

In the analysis of Intangible Assets, it is essential to define their composition and structure. But again, there is no uniformity about this problem in the researchers' environment, although a certain general understanding of Intangible Assets composition still exists. Thus, in [Sveiby, 1997, p.10-11] it is determined, that Intangible Assets of a company consist of internal (patents, concepts, licenses, administrative system, organizational structure etc.) and external (brands, trademarks, relations with customers and suppliers etc.) organization structures as well as of the competence of its personnel. According to [Petty, Guthrie, 2000, p.158], Intangible Assets of a company include organizational (software systems, distribution networks, and supply chains) and human capital (within the organization — employee resources and external to the organization — suppliers and customers). The same approach is described in [Edvinsson, Mallone, 1997, p.52; Roos et al., 1997, p.57]. [Brooking, 1996, p.12] distinguishes the following constituents of Intangible Assets: market assets, intellectual property assets, human-centred assets and infrastructure assets.

A narrower understanding of Intangible Assets is submitted in [Mayo, 2001, p.31–37; Ahonen, 2000, p.45]. These papers claim that the base of a company's Intangible Assets is constituted namely by human capital, which requires consideration from three points of view: as the amount of employees, as employees' personal properties and as work community (organization).

On the contrary, a considerably broader definition of Intangible Assets is rendered in [Andriessen, Tissen, 2004]. These researchers distinguish five asset groups that may be referred to intangible ones: valuable re-

sources and acquisitions, attainments and non-formalized knowledge, primary processes and managerial processes, technologies and formalized knowledge as well as common moral values and norms.

The position of the authors of the paper concerning the problem of composition and structure of Intangible Assets is in many respects based on Intangible Assets classification developed by *International Federation of Accountants* (IFAC, 1998). It is conceived, that three elements can be marked out in Intangible Assets structure: Human, Relationship and Structural (Organizational) Capital (see Figure 2).

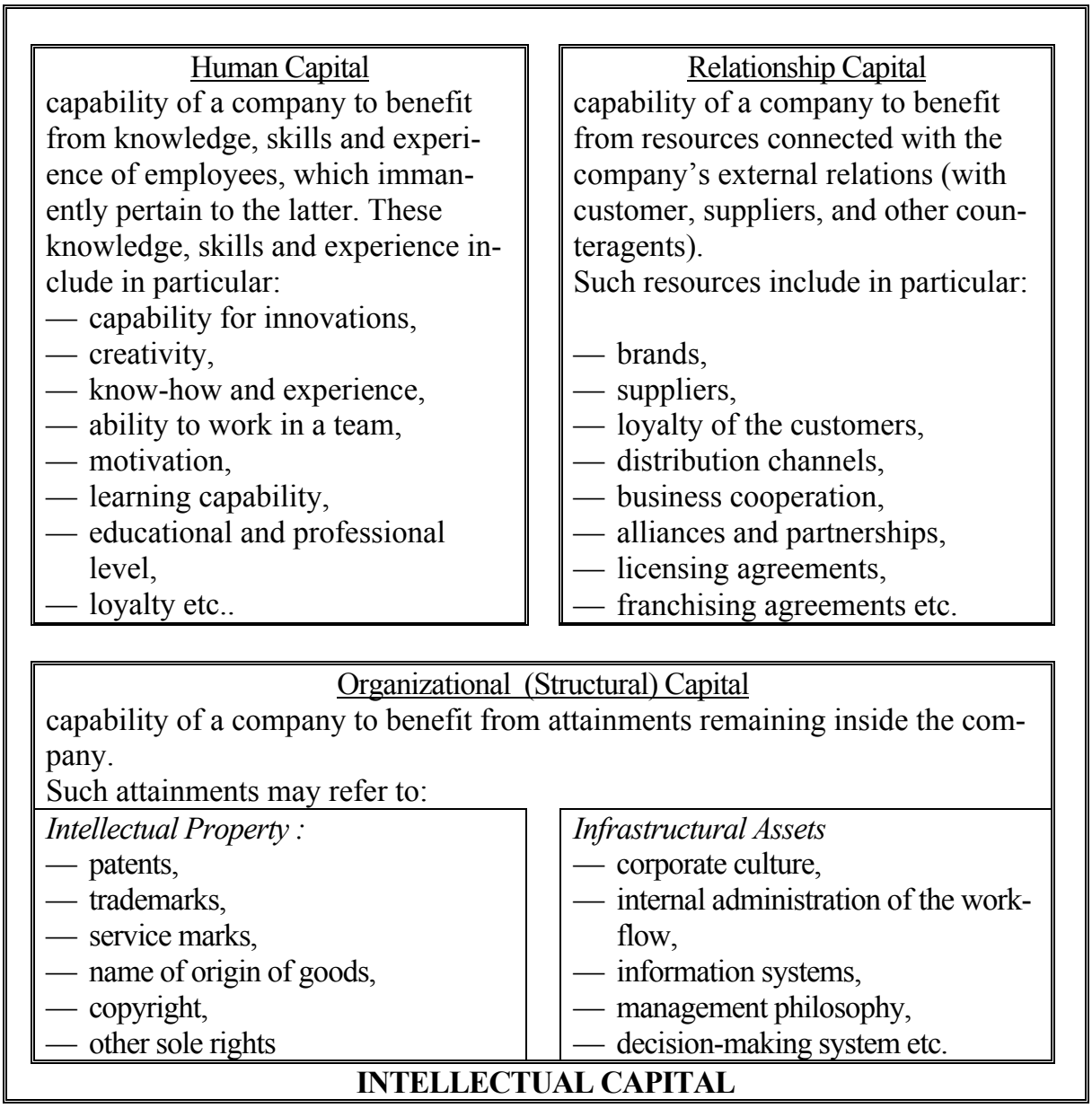

Figure 2. Intellectual Capital Structure

Human capital by IFAC — knowledge, skills and experience which employees "take with them", when they leave the company. However, we

define human capital as a capability of a company to benefit from knowledge, skills and experience of employees, which immanently pertain to the latter. The examples of such intellectual properties of the employees are: capability for innovations, creativity, know-how and experience, ability to work in a team, motivation, learning capability, educational and professional level, loyalty etc.

Relationship capital by IFAC — resources connected with external relations of company, i.e. the relations with customers, suppliers, and other counteragents. We defined the relationship capital as the capability of a company to benefit from resources connected with the company's external relations.

Organizational (Structural) Capital by IFAC — the attainments remaining inside the company. We define the structural capital not just like attainments, but like the capability of a company to benefit from attainments remaining inside the company. The structural capital in its turn may be divided into two subgroups: intellectual property and infrastructural assets (corporate culture, internal administration of the workflow etc.).

EVALUATION OF INTANGIBLE ASSETS: THE METHOD OF CALCULATED INTANGIBLE VALUE

The Intangible Assets evaluation problem is immensely complicated and disputable. Apart from the specific character of the evaluated subject (its intangibility), the difficulty of the problem is connected with the fact that in this case the evaluation models not only give the numerical evaluation, but also in a certain way determine the essence of the evaluated subject.

A great number of papers are devoted to the problem of Intangible Assets evaluation. The reviews of various approaches to this kind of assets evaluation are presented in the works by [Luthy, 1998; Sveiby, 2002; Bontis, 2001; Petty, Guthrie, 2000; Andriessen, Tissen, 2004]. Besides, some Russian researchers also develop the above problem in their works [Kozyrev, Makarov, 2003; Bukhvalov 2004a; 2004b; 2004c]. The task of this paper does not include the detailed analysis of all existing approaches; therefore we have chosen only one approach for this purpose.

As a general approach used herein for IA evaluation, we have chosen the method of *Calculated Intangible Value (CIV)* offered by T. Stewart [Stewart, 1995]. According to CIV, intangible value of a company is determined as a difference between the company's value (which, in its turn, is determined by the book value of the company's assets and discounted flow of residual operating income) and the possessed value of its tangible assets (determined by the book value of these assets and discounted flow of residual earnings using the average industrial rate of return). This differ-

ence characterizes the company's capability to use the Intangible Assets in order to "outrun" the competitors in the industry. The increasing intangible value shows the company's capability of generating income in the future. The decreasing intangible value displays that the company's investments do not pay their way or that the company invests too much into tangible assets. The CIV allows making both intra- and inter-branch comparisons within companies that is of current importance in Russian present-day reality.

The main problems of using this method are the following. Firstly, the basic criterion of the CIV is the return on assets (ROA). However, for some companies it may be overestimated, underestimated or even negative. Secondly, it is rather complicated to determine the factor of weighted average cost of capital that is necessary for using the CIV. And thirdly, the calculated intangible value is an aggregated factor that does not allow extinguishing separate components from Intangible Assets.

The calculation of Intangible Assets value in accordance with the chosen valuation method (CIV) is based on the residual operating income (REOI) model as a variant of fundamental value of equity model. The residual income model, the theoretical evidence in this research area, the practical application of the model, the fundamental works and present-day publications on the point are presented in [Volkov, 2006b, 2005a, 2005b, 2004a; 2004b; Bukhvalov, Volkov, 2005a, 2005b; Volkov, Berezinets, 2006a, 2006b].

Besides, a paper by [Bukhvalov, Volkov, 2005a, 2005b] displays the analysis of Russian companies in order to test the hypothesis that "book value of equity and residual earnings value are able to define the current market value of the company"[1]. In the same article, the authors mention the appearance of increasing quantity of works devoted to the resource-based view on the company stressing on the role of exclusive assets of companies, which "shifts the task of a company's valuation to the valuation of its intangible assets", that evidences the urgency and actuality of the researched subject.

As mentioned above, the basis for valuation in this paper is the REOI model:

$$V_E^{REOI_j} = E_0^{BV} + \sum_{j=1}^{\infty} \frac{REOI_j}{(1+k_W)^j} = \left[NA_0^{BV} + \sum_{j=1}^{\infty} \frac{REOI_j}{(1+k_W)^j} \right] - D_0 \ , \qquad (1)$$

where V_E^{REOI} — the fundamental value of equity according to the REOI model;

E_0^{BV}, NA_0^{BV}, D_0 — book value of equity, net assets and debt at the

[1] A similar research, with the market price per share and market sales multiplier being the explanatory variables, is carried out in (Volkov, Berezinets, 2006a, 2006b).

moment (respectively);

$REOI_j$ — residual operating income in year j. REOI variant is EVA (economic added value);

k_W — weighted average cost of capital ($WACC$)

The value in square brackets in the formula (1) is a fundamental value of assets according to the REOI model (V_A):

$$V_A^{REOI_j} = NA_0^{BV} + \sum_{j=1}^{\infty} \frac{REOI_j}{(1+k_W)^j}. \quad (2)$$

Here, the residual operating income equals the residual earnings after deducting the cost of invested capital:

$$REOI_j = NOPAT_j - k_W \times NA_{j-1}^{BV}, \quad (3)$$

where $NOPAT$ — net operating profit after taxes (also *EBI – earnings before interest*), calculated according to the formula:

$$NOPAT = NI + i \times (1-t), \quad (4)$$

where NI — net income

I — interest

T — income tax rate according to the income statement

If in expression (2) we presume that $REOI$ value is constant within infinite research period, ($REOI = const$)[2], then model (2) may be presented as:

$$V_A^{REOI} = NA_0^{BV} + \frac{REOI}{k_W}. \quad (5)$$

Let us divide the book value of net assets into two constituents: tangible assets (NA_T) and intangible assets (NA_I). The upper index BV means that the assets are taken according to their book value:

$$NA^{BV} = NA_T^{BV} + NA_I^{BV}. \quad (6)$$

Let us presume that intangible assets are not reflected in the balance sheet at all, or their part in the book value is small enough to be neglected. Then, expression (6) transforms as follows:

$$NA^{BV} = NA_T^{BV}. \quad (7)$$

If accepting the presumption (7), model (5) turns into:

$$V_A^{REOI} = NA_T^{BV} + \frac{REOI}{k_W}. \quad (8)$$

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[2] This assumption complies with the allowance of linear information dynamics (*LID*). *LID* is defined as the linear stochastic process, expressing time changes and correlation of accounting and non-accounting variables. *LID* gives forecast for future expected residual earnings value, resting on the actual value of accounting variables and other information at present time. Detailed variants of valuation models under various LID modifications are examined in (Volkov, 2006; Volkov, Berezinets, 2006a, 2006б).

Hence, the *REOI* defines the effect obtained by a company from both tangible and intangible assets. The main problem lies in dividing the general effect into constituent factors. In order to solve the problem, we shall set up the following interconnected hypotheses.

Hypothesis 1. The companies referring to the same industry are characterized by approximately similar structure of assets. Therefore we may presume that one monetary unit invested into tangible assets gives the same return throughout all the companies of the industry.

Hypothesis 2. The intra-branch differences in return of companies are explained only by exclusive intangible assets of each company.

If to accept the mentioned hypotheses, then:

— the return on tangible assets is the same for all companies and equals the average industry return rate;

— the return on intangible assets is the difference between the actual return of a company and average return in industry. In this sense, the effect of intangible assets on general return rate may be either positive (if a company's return rate prevails the average industry return rate), or negative (if opposite).

From the above, we draw two principal conclusions:

— the fundamental value of a company's equity may be either positive or zero (if the average industry return is larger than or equals zero);

— the fundamental value of intangible assets may be either positive or negative, if the average industry return is non-negative.

Accepting the above presumptions, we shall distinguish in the REOI model the effects induced by tangible and intangible assets. For that, we shall re-arrange the expression (3) taking into account the presumption (7) as follows:

$$REOI = NOPAT - k_W \times NA_T^{BV} \pm RONA_{IAVG} \times NA_T^{BV}, \quad (9)$$

where $RONA_{IAVG}$ — industry average returns on net assets.

In the result of the re-arrangement we get:

$$REOI = \left[NOPAT - RONA_{IAVG} \times NA_T^{BV}\right] + \left[RONA_{IAVG} \times NA_T^{BV} - k_W \times NA_T^{BV}\right]. \quad (10)$$

Granting (5), expression (11) may be rewritten as follows:

$$REOI = \left[NA_T^{BV} \times \left(RONA - RONA_{IAVG}\right)\right] + \left[NA_T^{BV} \times \left(RONA_{IAVG} - k_W\right)\right]. \quad (11)$$

The expression in the first square brackets of formula (11) may be interpreted as residual operational income generated by intangible assets ($REOI_I$); the expression in the second square brackets – as residual operational income generated by tangible assets ($REOI_T$):

$$REOI_I = NA_T^{BV} \times \left(RONA - RONA_{IAVG}\right), \quad (12)$$

$$REOI_T = NA_T^{BV} \times \left(RONA_{IAVG} - k_W\right). \quad (13)$$

The fundamental value of assets formula (5) subject to (12) and (13) may be presented as:

$$V_A^{REOI} = NA_T^{BV} + \frac{REOI}{k_W} = \left[NA_T^{BV} + \frac{REOI_T}{k_W} \right] + \left[\frac{REOI_I}{k_W} \right] = V_T + V_I, \quad (14)$$

where fundamental value of a company's assets can be divided into the fundamental value of tangible assets (V_T) and intangible assets (V_I) as follows:

$$V_T^{REOI} = NA_T^{BV} + \frac{NA_T^{BV} \times (RONA_{IAVG} - k_W)}{k_W} = \\ = NA_T^{BV} \times \left(1 + \frac{RONA_{IAVG} - k_W}{k_W} \right) = NA_T^{BV} \times \frac{RONA_{IAVG}}{k_W}, \quad (15)$$

$$V_I^{REOI} = \frac{REOI_I}{k_W} = NA_T^{BV} \times \frac{RONA - RONA_{IAVG}}{k_W}. \quad (16)$$

THE DRAFTING OF THE RESEARCH MODELS

Three models of the regression analysis which characterize the relationship between the market-value of assets and the fundamental value of tangible and intangible assets are analyzed in this research.

The market-value of a company's assets can be characterized by such subordination:

$$P_A^M = P_E^M + P_D^M, \quad (17)$$

where P_A^M, P_E^M, P_D^M – the market-value of assets, equity and debt thereafter.

Considering that the market-value of equity is market capitalization (Cap), and the market-value of dept (D) is usually assumed as its book value, equation (17) can be rewritten as:

$$P_A^M = Cap + D. \quad (18)$$

The market-value of assets for the model calculation appointed as average weighted market capitalization to the content of bids over a period of 2nd quarter, which follows after the accounting year[3], plus book value of debt to the end of the accounting period.

Thereby the single-factor model, where the influence of fundamental value of intangible assets (V_I), which is appointed by the term (16), upon the market-value of assets of a company, is shown, looks like the following:

$$P_A^M = \beta_0 + \beta_1 \times V_I + \varepsilon_1, \quad (19)$$

[3] The ground of such method of calculation of market capitalization is represented particularly in [Volkov, 2006b; Volkov, Berezinets, 2006a, 2006b]

where β_0, β_1 - coefficients of the regression equation;
ε_1 - random error.

The model which allows to evaluate the influence of fundamental value of tangible assets (V_T), appointed by the term (15), upon the market-value of a company's assets, looks like the following:

$$P_A^M = \lambda_0 + \lambda_1 \times V_T + \varepsilon_2, \quad (20)$$

where λ_0, λ_1 - coefficients of the regression equation;
ε_2 - random error.

The third model is a two-factor one which includes the influence of fundamental value of both tangible and intangible assets upon the market-value of assets of a company:

$$P_A^M = \mu_0 + \mu_1 \times V_T + \mu_2 \times V_I + \varepsilon_3, \quad (21)$$

where μ_0, μ_1, μ_2 - coefficients of the regression equation;
ε_3 - random error.

STATISTICAL INFORMATION

The test of hypothesis was held on the sample of Russian companies-emitters, which sell their stocks within the Russian Trade System (RTS). Financial intermediaries (banks and financial institutes) were not included into the sample in order to keep the data uniformity. The final sample includes 43 companies. Firstly, three econometric models were checked on the whole sample of the companies, and then separately on each industry. The companies are divided into 6 aggregated industries: mechanical engineering (includes aircraft industry and automobile manufacturing), extractive industry (includes oil holdings and oil-and-gas companies), power engineering, communication services, chemical industry and metallurgy (non-ferrous and ferrous metallurgy).

Information of the publicly available nonconsolidated financial accountancy of the companies from 2001 till 2005, accommodated on their sites, was used for analysis. The general content of the sample was 215 firm-years (43 firms during 5 years). At first, this number of firms was analyzed with the help of the approach introduced by Stewart. But after the correction of the approach, which will be described below, 172 firm-years contented the sample.

Primary information about the market capitalization of the researched companies was got from the site of stock exchange RTS

(www.rts.ru). An average weighted market capitalization was used in analysis. Market capitalization represented by RTS was recounted into rubles on the average course, because ruble was elected as a currency for all the accounts. One of the most important problems of this analysis that was mentioned above is a problem of weighted average cost of capital (k_W). An average *RONA* for each industry is taken as a value of k_W in this analysis. General statistical characteristics of the researched sample are represented in Table 1.

Table 1

General statistical characteristics of the researched sample

№	Name of the variables/characteristic	Mean	Mediana	Standard deviation
1	Market-value of the assets (mlrd.rub)	81 558	17 862	167 988
2	Fundamental value of tangible assets (mlrd.rub.)	62 091	19 841	123 426
3	Fundamental value of intangible assets (mlrd. rub.)	5 619	– 605	80 202

As it was shown before the method of Calculated Intangible Value (CIV) which was offered by T. Stewart, is used in this research for Intangible Assets valuation. Possibility of the application of this method on the example of Merck company was shown in (Stewart, 1995). Stewart used an average RONA for 3 years.

Firstly the authors of this paper tried to apply the same method for the research on the Russian market. The models were tested for finding relationship between the average market value of assets of companies and 5-year average fundamental values of tangible and intangible assets. Average RONA for 5 years was used in order to calculate the fundamental values. But an application of this method showed to be not correct as the size of the sample in the each industry was not big enough.

The authors supposed that in Russian conditions upon the market value of assets in the analyzed year the most influence have fundamental values and respectively RONA of the previous year. By this fact the dependence between market value of assets of the current year and fundamental values of tangible and intangible assets, based on the parameters of the previous year was analyzed in three introduced models.

THE RESULTS OF THE RESEARCH

The 1st stage of the research is an estimation of the regression equation on the whole sample of the analyzed companies-emitters.

As it is known the coefficient of determination R^2 is explains the proportion of the variance (fluctuation) of one variable that is predictable

from the other variable. It is a measure that allows us to determine how certain one can be in making predictions from a certain model.
The test of the model (19) brings the following results.

The coefficient of determination equals 0,341 and the whole equation and coefficients are significant. Thus with required rate of return being equal 13,44%, the considered equation is:

$$\hat{P}_A^M = 45731{,}8 + 0{,}5201 \times V_I . \quad (22)$$

T-test is used for the analysis of significance of explanatory variables (Student criterion), and F-test (Fisher criterion) is used for testing the models for adequacy. Null and alternative hypotheses are stated in the following way:

$$H_0 : \beta_1 = 0,$$
$$H_1 : \beta_1 \neq 0.$$

If null hypothesis is rejected and the alternative hypotheses is accepted, that means that market value of assets depends on the fundamental value of intangible assets. The value of t-statistics is calculated and compared with t critical in order to test the hypotheses. In our case the calculated value of t-statistics equals 3,84 and with 5% confidence level t critical equals 1,974. If

$$-t_{\text{crit}} < t < t_{\text{crit}}$$

is not carried out, null hypothesis should be rejected and the alternative hypothesis should be accepted. That means that the market value of assets of Russian companies depends on the fundamental value of intangible assets.

The regression equation (20), the parameters of which are estimated with the help of Least Square Method, is the following:

$$\hat{P}_A^M = 4823{,}391 + 1{,}1299 \times V_T . \quad (23)$$

There the coefficient of determination equals 0,8044, that means that the obtained regression equation explains for 80,44% the modification of the market value of assets of a company with the help of the fundamental value of its tangible assets. In our case the calculated value of t equals 20,82 and the critical one equals 1,974, that means that null hypothesis should be rejected. Thus we can accept the assumption that in Russian conditions the market value of assets of a company depends on the fundamental value of its tangible assets.

So it can be concluded that in Russian conditions the market value of assets of a company depends on fundamental values of both tangible and intangible assets.

The analysis of two-factor model allows to draw the conclusion, in what degree each of the independent parameters influence the dependent one. As the result of the test the following regression equation is obtained:

$$\hat{P}_A^M = 8{,}0923 + 1{,}0966 \times V_T + 0{,}2689 \times V_I. \quad (24)$$

In this case the value of the coefficient of determination and adjusted coefficient of determination have high values (0,8199 and 0,8088 respectively), what says about the tight relationship between the analyzed variables. That means that in Russian conditions the market value of assets of companies for 81,99% depends on the fundamental value of its tangible and intangible assets.

The following hypotheses are formulated in order to test the significance of the explanatory variables, which the model contains:

$$H_0^1 : \mu_1 = 0, \quad H_1^1 : \mu_1 \neq 0$$
$$H_0^2 : \mu_2 = 0, \quad H_1^2 : \mu_2 \neq 0$$

As the test shows, null hypotheses can be rejected on both explanatory variables and that means that the market value of assets of Russian companies depends on fundamental value of both tangible and intangible assets. The results of the analysis concerning model (21) are represented in Table 2.

Table 2

The results of testing two-factor model (21) for the whole sample

№	Statistical characteristic	Estimators of coefficients	
		m_1	m_2
1	Standard error	0,0529	0,0721
2	*t*-statistics	20,7	3,73
3	*t* critical (5%-confidence level)	1,9741	1,9741
4	**The conclusion about null hypothesis according to the results of t-test**	**To reject**	**To reject**
5	Confidence interval (5%- significance level)		
	— lower bound	0,9919	0,1265
	— upper bound	1,2013	0,4113
6	*F*-statistics	73,32	
7	*F* critical (5%- significance level)	3,0491	
8	**The conclusion about null hypothesis according to the results of *F*-test**	**To reject**	**To reject**

The 2nd stage of the research concerns the analysis of models on the sample that is divided into 5 selected industries: mechanical engineering (1), extractive industry (2), power engineering (3), communication services (4) and metallurgy (5). Chemical industry was excluded because of the shortage of sample. The results of the analysis of single-factor models (19), (20) and two-factor model (21) are represented in Tables 3–5.

Table 3

The results of testing single-factor model (19)

№	Statistical characteristic	Industry				
		(1)	*(2)*	*(3)*	*(4)*	*(5)*
1	Coefficient of determination R^2	0,1156	0,1038	0,5368	0,4464	0,3821
2	Standard error	0,2333	0,4630	0,1142	0,1188	0,3241
3	Confidence interval (5%- significance level)					
	— lower bound	– 0,4004	– 0,3698	0,5556	0,0062	– 1,7962
	— upper bound	0,5942	1,5169	1,0162	0,4907	– 0,1867
4	*t*- statistics	0,42	1,24	6,88	2,09	2,66
5	*t* critical (5%-significance level)	2,101	2,032	2,0129	2,0322	2,101
6	**The conclusion about null hypothesis according to the results of t-test**	**To accept**	**To accept**	**To reject**	**To reject**	**To reject**

Table 4

The results of testing single-factor model (20)

№	Statistical characteristic	Industry				
		(1)	*(2)*	*(3)*	*(4)*	*(5)*
1	Coefficient of determination R^2	0,2787	0,7288	0,8418	0,7308	0,8529
2	Standard error	0,2865	0,1212	0,1027	0,1640	0,1146
3	Confidence interval (5%- significance level)					
	— lower bound	– 0,0667	0,8182	1,3217	0,7251	0,9335
	— upper bound	1,1545	1,3157	1,7359	1,3939	1,5229
4	*t*- statistics	1,9	8,75	14,88	6,46	8,82
5	*t* critical (5%-significance level)	2,101	2,032	2,013	2,032	2,101
6	**The conclusion about null hypothesis according to the results of t-test**	**To accept**	**To reject**	**To reject**	**To reject**	**To reject**

Table 5

The results of testing two-factor model (21)

№	Statistical characteristic	Industry				
		(1)	(2)	(3)	(4)	(5)
1	Coefficients of determination					
	— R^2	0,3242	0,7566	0,8425	0,7648	0,8811
	— adjusted R^2	0,0829	0,7166	0,8238	0,7256	0,8386
2	Standard errors					
	— coefficient *m*1	0,3725	0,1176	0,1762	0,1578	0,1602
	— coefficient *m*2	0,2739	0,2454	0,1146	0,0797	0,2211
3	*t*-test (5%-significance level)					
	— *t* critical	2,109	2,035	2,014	2,034	2,109
	— *t*- statistics (*m*1)	2,08	8,97	9,03	6,37	7,66
	— *t*- statistics (*m*2)	– 0,97	2,05	2,44	2,08	1,82
4	**The conclusion about null hypothesis according to the results of t-test**	**To accept**	**To reject**	**To reject**	**To reject**	**To reject**
5	Confidence interval (5%- significance level)					
	— coefficient *m1* lower bound upper bound	– 0,0245 1,5735	0,8149 1,2954	1,2363 1,9478	0,6837 1,3286	1,0045 1,8312
	— coefficient *m*2 lower bound upper bound	– 0,8538 0,3215	– 0,0475 0,9549	– 0,2821 0,1803	0,0032 0,3289	– 0,1964 0,8939
6	*F*- test (5%-significance level)					
	— *F* critical	3,555	3,2759	3,1996	3,2759	3,555
	— *F*- statistics	1,34	18,65	44,95	19,51	19,07
7	**The conclusion about null hypothesis according to the results of *F*- test**	**To accept**	**To reject**	**To reject**	**To reject**	**To reject**

While testing the model (19) the following facts were found out: the relationship between the market value of assets of companies and the fun-

damental value of intangible assets was better explained in such industries as power engineering and communication services where coefficients of determination equal 0,5368 and 0,4464 respectively. A little bit lower the level of relationship between the analyzed variables is in metallurgy, where the coefficient of determination equals 0,3821. Only in these industries null hypothesis is rejected. In all the other industries null hypothesis can not be rejected as the result of the analysis.

The test of model (20) revealed the following fact: the relationship between the market value of assets of companies and the fundamental value of tangible assets was better explained in such industries as metallurgy and power engineering. Coefficients of determination for both industries are more than 0,84. Despite of the fact that the value of R^2 in the other industries is a little bit lower, in all the industries, except mechanical engineering, null hypothesis is rejected and the alternative hypothesis is accepted.

And after testing the two-factor model (21) in all the industries, except mechanical engineering, a very close relationship between the analyzed variables was found. Coefficient of determination in all the cases is more than 0,756. Null hypothesis is rejected in all the industries, which means that the market value of assets depends on the fundamental value of tangible and intangible assets in all the researched branches.

We can make a conclusion that on the Russian market the influence of fundamental value of tangible assets on the market value of assets of a company surpasses the influence of fundamental value of intangible assets upon the same parameter. And also on average the contribution of one monetary unit into tangible assets brings more profit than the same contribution into intangible assets (Table 6).

The estimators of the coefficients that were obtained after testing the models on aggregated industries can be interpreted in such a way. The most increase of the market value of a company's assets gives an extra ruble, invested into intangible assets, in power engineering industry (19,64 rub.). Then there go the companies of extractive industry and communication services (4,09 rub. and 3,11 rub. respectively).

If we speak about investing monetary units into tangible assets, the most increase of the market value of a company's assets gives an extra ruble invested again in power engineering (38,22 rub.). If you invest one ruble into tangible assets of the companies that belong to communication services, you can get 13,24 rub., to extractive industry – 7,62 rub.

Thus, in power engineering industry any investing of monetary units whether into tangible or intangible assets gives the most increase of the market value of a company's assets comparing to the other researched industries.

Table 6

Influence of investing into tangible and intangible assets on the market value of a company's assets

	All the industries	*By the industries*				
		Mechanical engineering	Extractive industry	Power engineering	Communication services	Metallurgy
Investing in intangible assets (rub.)	4,16	0,81	4,09	19,65	3,11	– 4,54
Investing in tangible assets (rub.)	9,04	4,53	7,62	38,22	13,24	5,32

All in all, the main problem of the Russian market is that rather a big number of companies do not reflect Intangible Assets in their balance-sheet or the carried evaluations are nominal ones. This question is discussed in different publications, where it is said about the problem that the most important resources of a company, which are Intangible Assets, are often not reflected in companies' balance-sheets [Edvinsson and Mallone, 1997; Sveiby, 1997].

The results of the held research concerning all the industries completely confirm the following conclusions:

- the fundamental value of a company's tangible assets can be positive or zero (if an average return rate is more or equals zero). In the research this variable was strictly more than zero for all the companies on the Russian market;
- the fundamental value of a company's intangible assets can be positive or negative if the average industry rate of return is non-negative (for example, in such industries as automobile car construction, oil-and-gas companies and non-ferrous metallurgy).

The main problem in the realization this kind of research on the Russian market is the shortage of statistical information. A bigger number of companies-emitters match the necessary parameters of sample, but their reporting is not publicly available. That is why further research in this field will be based on the accumulated statistical information.

CONCLUSION

In the paper some questions connected with Intangible Assets definition, structure and valuation are discussed. The main aim of the research was to find out whether there is a connection between the market value of a company's assets and the fundamental value of its tangible and intangible assets. Financial information concerning 43 companies-emitters, which trade their stocks on Russian Trade System from 2001 till 2005, was used in the analysis.

Three models of regression analysis are represented in the work. Two of them are single- factor ones and characterize the relationship between the market value of a company's assets and the fundamental value of its tangible and intangible assets respectively. The 3rd model is a two-factor one and allows to reveal the influence of separate components of the model upon the market value of a company's assets.

As the represented two-factor model is the most completed, let us make the main conclusions. The estimator of the coefficient m_1 of the regression equation (the fundamental value of tangible assets) shows the effectiveness of the invested money into tangible assets of a company. One monetary unit invested into tangible assets should give the same return for all the companies belonging to the same industry, as it was mentioned above. The estimator of the coefficient m_2 of the regression equation (the fundamental value of intangible assets) testifies intra-branch differences in the return of companies' assets. Return which is given by intangible assets is the difference between a company's expected return rate and industry average return rate. Concerning the whole sample of the researched companies the following results were obtained. Every extra ruble invested into intangible assets brings 4,16 rub, into tangible assets — 9,04 rub. of the market value of assets (with average market rate k_w=12,5%).

The results which were obtained in the research generally matched the expected ones. But we can make an assumption that they could change if the size of the sampled were bigger.

As it was said in this paper the results which are based on the Calculated Intangible Value method are represented. The further research in this field will develop not only the direction of testing the analyzed models for sustainability as statistical information accumulated, but also the direction of developing and testing other models of Intangible Assets valuation. Moreover, the question of Intangible Assets structure demands the further specification, and also the problem of extracting separate elements of Intangible Assets from their aggregate value needs to be solved.

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